Shri Vile Parle Kelavani Mandal's
SHRI BHAGUBHAI MAFATLAL POLYTECHNIC
Irla juhu Road, Vile Parle (West) Mumbai-400 056
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Electrical Engineering Department

SEMESTER-IV & V

SCHEME -2022

Shri Vile Parle Kelavani Mandal's

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

TEACHING AND EXAMINATION SCHEME

FULL TIME

PROGRAMME: ELECTRICAL ENGINEERING **With effect from Batch admitted in June, 2022(Progressively)**

SEMESTER-IV **Duration : 16 Weeks**

Sr. No	Course Name (Code)	Scheme of Instruction & Periods per week					Theory Paper Duration and Marks		Examination Scheme and Maximum Marks							Gr.	Scheme L/P/Cr
		L	P	D	T	Cr (L+P+D+T)	Hrs	Mks	SSL	TA	Paper	TW	PR	OR	TOTAL		
1	# Switchgear & Protection **(SGP220311)**	4	-	2	-	6	3	70	20	10	70	50	-	50	200	A	4/2/6
2	Power Electronics **(PEX220312)**	4	2	-	-	6	3	70	20	10	70	25	50	-	175	A	4/2/6
3	# Electrical Contracting & Estimation **(ECE220313)**	4	-	2	-	6	3	70	20	10	70	50	-	50	200	A	4/2/6
4	# DC & Synchronous Machines **(DSM220314)**	4	2	-	-	6	3	70	20	10	70	50	50	-	200	C	4/2/6
5	**Elective -I (Any One)**																
5.1	Utilization of Electrical Energy **(UEE220315)**	4	2	-	-	6	3	70	20	10	70	25	-	50	175	A	4/2/6
5.2	Renewable Energy Sources **(RES220316)**	4	2	-	-	6	3	70	20	10	70	25	-	50	175	A	4/2/6
5.3	Energy Audit & Conservation **(EAC220317)**	4	2	-	-	6	3	70	20	10	70	25	-	50	175	A	4/2/6
		20	**06**	**04**	**-**	**30**	**No of Papers = 05**		**100**	**50**	**350**	**200**	**100**	**150**	950		
		Total Periods : 30							**Total Marks :950**								20/10/30

Theory , Practical, Drawing and Tutorial periods of 1 Hour each = 1 Credit, # Award winning subject, @ Online Examination

L-Lecture period, P-Practical period, D- Drawing Practice, T- Tutorial, Cr-Credit, ESE: End Semester Examination, SSL –Sessional, TA- Teachers Assessment, TH- Theory, TW- Term Work, PR- Practical, OR-Oral, Gr-Group,, B-Basic, C-Core, A-Applications, M-Management, PR/OR- Assessed by Internal and External Examiners jointly, TW- Assessed by Internal Examiner Only

Head of Department **Controller of Examination** **Secretary CDC** **Principal**

1.COURSE DETAILS:

Programme: Electrical Engineering	**Semester: IV**
Course: # Switchgear & Protection	**Group: A**
Course Code: SGP220311	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instructions and Periods per Week					**Examination Scheme and Maximum Marks**							
Theory Hrs L	**Practical Hrs P**	**Drawing Hrs D**	**Tutorial Hrs T**	**Credits (L+P+D +T)**	**Theory Paper Duration and marks(ESE)**		**SSL**	**TA**	**TH**	**TW**	**PR**	**OR**	**TOTAL**
					Hours	**Marks**							
04	-	2	-	06	03	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE

Technician must be aware of continuous need of electric supply, as nobody in this era can tolerate interruption even for small duration of time, this is made possible by called a device "Switchgear "which ensure continuity of supply and prevent damage of costly equipment in factories. Thus arises need of remote sensing of fault & hence various relay systems & protection scheme are suggested in subject, which takes care of protection of generator, transformer, transmission lines & receiving station.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

- **Maintain switchgear and protection schemes used in power system**

5.COURSE OUTCOMES (COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Describe various types of switchgear equipment used in power system.
CO2	Use different methods of protection for various power system components.
CO3	Describe overvoltage protection of power system.
CO4	Choose appropriate grounding system for various equipment

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO 2
#Switchgear & Protection (SGP220311)	CO1	1	-	3	2	2	2	-	3	2
	CO2	2	2	3	2	1	2	2	3	2
	CO3	2	2	3	2	-	2	1	3	2
	CO4	1	2	3	-	2	2	1	2	2
	CO Avg.	**1.50**	**2.00**	**3.00**	**2.00**	**1.66**	**2.00**	**1.33**	**2.75**	**2.00**

7. COURSE CONTENTS

UNIT NO.	Topic/Sub-Topic	CO
I	**Switches:** 1.1Isolator- types of isolators- rating of isolators. 1.2 Bus bar arrangement, 1.3 switchgear in generating stations. Main switchgear and auxiliary switchgear. 1.4 Requirements of fuse, 1.5 Different types of fuses-Rewireable, H.R.C, Expulsion type, Draw-out fuses. 1.6 Characteristics and different ratings of fuses.	CO1
II	**Relays and contactor** 2.1 Introduction, Quality requirements of relay, important terms related to relay 2.2 Protection zones, primary and backup protection 2.3Types-Electromagnetic Relay, Induction Relay, overcurrent Relay, power Relay, directional overcurrent Relay, Distance Relay, Static Relay (block diagram)., 2.4 Introduction to Numerical relay. 2.5 Construction ,operation, application of contactor	CO1
III	**Circuit Breakers** 3.1 Requirement of circuit breaker. Difference in fuse and circuit breaker. 3.2 Theory of arc extinction in direct current and in alternating current circuits. 3.3 Recovery of voltage, Restriking voltage, rate of rise of restriking voltage. 3.4 Types-Construction, principle of operation, operating mechanisms of Bulk Oil Circuit Breaker (BOCB) Minimum oil content (small oil volume SOV) circuit breakers vacuum circuit breakers (VCB) SF6 circuit breaker (Single Pressure and Double Pressure type) 3.5 Making, breaking capacities, contact materials.	CO1

	3.6 L.T Circuit breakers 1.Air Circuit Breaker (ACB), 2.Miniature circuit breakers (MCB), 3.Moulded case circuit breakers (MCCB), 4.Earth Leakage circuit breakers (ELCB or RLCB), 5.Comparison of Fuse and MCCB	
IV	**Protection systems** 4.1 Necessity, functions of protective system. 4.2 Normal and abnormal conditions. 4.3 Types of faults and their causes. 4.4 Need of current limiting reactors and their arrangements. 4.5 protection schemes for **1 Generators:** a) Merz price protection, b) Earth fault protection **2 Transformers:** a) Over current and earth fault protection b) Percentage differential protection. **3 Motors:** a) over current protection, b) Earth fault Protection **4 Bus bars, feeders and transmission lines:** a) Differential protection b) Directional over current protection c) Definite distance relay protection d) Inverse time over current protection 4.6 Basic block diagram of SCADA	CO2
V	**Overvoltage Protection** 5.1Causes of over voltages. 5.2 Lightning phenomena and over voltage due to lightning. 5.3 Protection of transmission line and substation from direct stroke. 5.4 Construction and principle of operation of different types of lightning arrestors such as Rod gap, horn gap, Expulsion-type lightning arrester, Metal-Oxide Lightning arrester 5.5 Surge absorbers (Definition, construction and working of different types)	CO3
VI	**Neutral Grounding** 6.1 Introduction 6.2Necessity of neutral grounding and Arcing Ground Phenomena 6.3Different methods of neutral grounding, advantages and disadvantages of neutral grounding. 6.4 Comparison between earthing & neutral grounding	CO4

8. LIST OF PRACTICALS AND DRAWING SHEETS:

Term Work consists of minimum 5 Practicals and 5 Drawing sheets from the following.

Sr No.	Title of Practical	Approx. HRS required	CO
1.	Identify the components of different types of isolators with their specifications. (through visits , video).	2	CO1
2.	Dismantle MCB / MCCB and identify their various parts.	2	CO1
3.	Demonstrate SF6 & Vacuum CB model (through Video)	2	CO1
4.	Calculate Plug Setting Multiplier & Time Setting Multiplier of induction type electromagnetic relay.	2	CO1
5.	Demonstration of IDMT Relay	2	CO1
6.	Simulate overcurrent protection scheme for 3-phase transmission line using the available kit.	2	CO2
	Title of Drawing Sheet		
1.	Draw different types of Isolators, Bus-Bar Arrangements and Fuses	4	CO1
2.	Sketch the constructional details, scheme details of different types of relays.	4	CO1
3.	Sketch the constructional details, scheme details of different types of Circuit Breaker	4	CO1
4.	Sketch the constructional details, scheme details of Different protection schemes for Transformer, Induction Motor, Alternator and protection devices. (2Sheets)	4	CO2
5.	Draw different types of Devices used for overvoltage protections.	2	CO3
6.	Draw different methods of neutral grounding.	2	CO4
	Total	**32**	

9.TEACHERS ASSESSMENT (TA): Assessment to be based on one of the following tools and rubrics for evaluation of TA to be well defined by course teacher.

1. Micro-Project
2. Seminar/ Presentation
3. Model/Chart making
4. Quiz

10. IMPLEMENTATION STRATEGY(PLANNING):

In depth study and understanding of the subject will be implemented by adopting following strategy.

1. Teaching Plan/Tutorials
2. Minimum no of drawings.
3. Industry visit
4. Guest/Expert lectures
5. Demonstrations/Simulations
6. Slides
7. Self Learning Online Resources

11. SUGGESTED LEARNING RESOURCES:

Sr.No.	Title of the Book	Author	Publication
1	S. S. Rao	Switchgear & protection	Khanna Publications
2.	V. L. Uppal Electrical	Electrical Power	Khanna Publication
2	V. K. Mehta Power System	Power System	Chand & Co
3	Soni, Gupta & Bhatnagar	Electrical Power	Dhanpatrai & sons
4	J.B.Gupta	Electrical Power	Khanna Publication

12 **WEBSITE REFFERENCES:**

1. www.nptel.ac.in
2. www.electricaltechnology.org
3. www.wikipidia.com
4. www.Electrical4u.com
5. www.Electrical powerinfo.com

13. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Switches	8	-	6	4	10
II	Relays and contactor	14	2	7	5	14
III	Circuit Breakers	14	2	4	8	14
IV	Protection systems	16	4	6	8	18
V	Overvoltage Protection	6	-	4	4	08
VI	Neutral Grounding	6	-	2	4	06
TOTAL		**64**	**8**	**29**	**33**	**70**

R Remembering, U Understanding, A Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs.The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		**NAME**
1	Internal	Mrs Ajayshree N. Kinhekar
2	Internal	Mr. Namdeo D.Adate
3	External	Mrs.Bhagyashree Firake Organisation: K.J.Somaiya,Polytechnic,Mumbai

1.0 COURSE DETAILS:

PROGRAMME: Electrical Engineering	**Semester: IV**
COURSE: Power Electronics	**Group: A**
Code: PEX220312	**Duration 16 weeks**

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
04	02	-	-	06	03	70	20	10	70	25	50	-	175

3. **OBJECTIVE:**

To become a perfect technician in electrical engineering, knowledge and applications of electronic Power Devices, AC-DC Motor controls, Inverters, Choppers and SMPS is essential. The knowledge of power electronics will assist the diploma engineers to upkeep the various power controlled **devices used** in power industry

4. **SKILL COMPETANCY:**

The aim of this course is to help the students to attain the following industry identified competency through various teaching-learning experiences

- **Maintain the power electronic devices and controlled circuits used in industries**

5. COURSE OUTCOMES (COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Select & Test appropriate power electronic devices or specific applications
CO2	Choose protection circuits and commutation techniques for specific applications
CO3	Maintain various types of controlled rectifiers
CO4	Maintain different types of chopper circuits
CO5	Maintain different types of inverter circuits
CO6	Use power electronic devices in various industrial applications

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Power Electronics (PEX220312)	CO1	3	-	2	2	1	2	2	3	2
	CO2	2	2	1	3	1	-	2	2	3
	CO3	2	2	3	2	-	2	1	3	2
	CO4	1	2	3	-	1	2	1	2	2
	CO5	3	2	1	-	1	-	-	2	3
	CO6	3	2	1	-	1	-	-	2	3
	CO Avg.	**2.33**	**2.00**	**1.83**	**2.33**	**1.00**	**2.00**	**1.50**	**2.33**	**2.50**

7. COURSE CONTENTS

Unit No	Topic/Sub-Topic	CO
I	**Thyristors and Other Switching Devices & Protection Circuits** 1.1 Power Semiconductor Devices 1.1.1 Thyristors (SCR), Two-Transistor Model of Thyristors 1.1.2 GTO, PUT, SUS, SCS, Light Activated Thyristor (LAT) 1.1.3 Diac, Triac, 1.1.4 IGBT 1.2. Characteristics of SCR, Diac and Triac. 1.3. Switching Characteristics of SCR and TRICS 1.4. Turn-on and Turn-off Methods in SCR and Triac. 1.5. SCR and Triac Ratings. 1.6 SIT: construction, working, V-I characteristics and applications 1.7 MCT: construction, working, V-I characteristics and applications 1.8 FCT : construction, working, V-I characteristics and applications	CO1
II	**Thyristor Protection Firing Circuits & Commutation Techniques** 2.1 Snobbier Circuit. 2.2 Over-Voltage Protection. 2.3 Over-Current Protection. 2.4 Gate Protection. 2.5 Firing Circuits for SCR and Triacs 2.6 Main Features of Firing Circuits. 2.7 Resistance & Resistance-Capacitive Firing Circuit. 2.8 UJT based Firing Circuit. 2.9 Pulse Transformer in Firing Circuit.	CO2
III	**Phase Controlled Rectifier** 3.1. Principle of Phase Control. 3.1.1.Single Phase Half-Wave Circuit With R-L Load.	

	3.1.2.Freewheeling Diode. 3.2.Full Wave Controlled Rectifier. 3.2.1.Single Phase Full Converter. 3.2.2.Single Phase Semi Converter. 3.3.Three Phase Full Converters. 3.4.Three Phase Semi Converters. 3.5.Three Phase Converter System Using Diodes. 3.6.Applications of SCR.	CO3
IV	**Choppers** 4.1 Principles of Chopper 4.2 Control strategies 4.2.1 Constant frequency system 4.2.2 Variable frequency system 4.3 Step up choppers 4.4 Types of chopper circuits 4.4.1 Type A,B, C, D and E Chopper circuits	CO4
V	**Inverters** 5.1 Operating principles of inverter 5.1.1 Single phase voltage source Inverters 5.1.2 Single phase bridge Inverters 5.2 Principles of operation of different inverter circuits 5.3 Inverter waveforms 5.4 Inverter using Thyristors 5.5 Series and Parallel Inverters 5.6 A.C Voltage Control 5.7 Application of Inverter 5.8 Switch mode power supply (SMPS) 5.9 Uninterrupted Power Supply (UPS) offline and online	CO5
VI	**Industrial Control Circuits :** 6.1 Applications of Burgular alarms system 6.2 Battery charger system using SCR 6.3 Emmergeny lighting system 6.4 SCR based AC and DC circuit breakers	CO6

8. LIST OF PRACTICALS AND DRAWING SHEETS:

Term Work consists of Journal containing minimum 10 number of Practical and 2-3 assignments

Sr No.	Title of Practical	Approx. HRS required	CO
1	Test and plot the functioning of IGBT characteristics	04	CO1
2	Test and plot the functioning of UJT triggering of SCR	02	CO1
3	Test and plot the functioning of Digital firing circuits	02	CO2
4	Check the performance of phase controlled rectifiers (any one Type)	02	CO3

5	Test the functioning of RC triggered HWR	02	CO4
6	Test the functioning of RC triggered FWR	02	CO4
7	Test the functioning of impulse commutated choppers	02	CO4
8	Check the performance of single phase/three phase series inverter	04	CO5
9	Check the performance of single phase/three phase parallel inverter	04	CO5
10	Test the functioning of study of SMPS	02	CO6
11	Test the functioning of study of UPS	02	CO6
12	Study the industrial applications of controlled circuits	04	CO6
13	Assignment on single phase and three phase SCR circuits	-	CO1
14	Assignment of power electronics devices	-	CO1
15	Assignment of applications of power electronics devices	-	CO6
	TOTAL	32	

9.TEACHERS ASSESSMENT (TA): Assessment to be based on one of the following tools and rubrics for evaluation of TA to be well defined by course teacher.

1. Micro-Project
2. Seminar/ Presentation
3. Quiz

10. IMPLEMENTATION STRATEGY(PLANNING):

In depth study and understanding of the subject will be implemented by adopting following strategy.

1. Teaching Plan/Tutorials
2. Minimum no of drawings.
3. Industry visit
4. Guest/Expert lectures
5. Demonstrations/Simulations
6. Slides
7. Self Learning Online Resources

11. **SUGGESTED LEARNING RESOURCES:**

Sr. No	Title of Book	Author	Publisher
1	Thyristors Control and Applications	Ramamurthy	
2	Electronics in Industry	Chute and Chute	Tata-Mcgraw Hill, New Delhi
3	Industrial Electronics	Cage	Tata-Mcgraw Hill, New Delhi
4	Industrial Electronics Lab Manual	Zbar	Tata-Mcgraw Hill, New Delhi
5	Industrial Electronics	Sameer Datta	PHI Publication, New Delhi
6	Power Electronics	P.S.Bimbhra	Khanna Publishers, New Delhi
7	Power Electronics, The Electrical Engineering Handbook	Rajashekara, K., Bhat, A.K.S., Bose, B.K.	

12 WEB REFERENCES:

1. https://www.electricaltechnology.org/2015/10/electrical-drives-ac-drives-vfd-dc- drives.html
2. https://www.electricaltechnology.org/2015/10/electrical-drives-ac-drives-vfd-dc- drives.html
3. www.nptel.ac.in/courses/108101038
4. www.ee.iitb.ac.in/-apel
5. www.tutorialpoint.com/power_electronics/
6. SEQUEL: software for power electronics
7. www.youtube.com

13. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Thyristors and Other Switching Devices & Protection Circuits	18	8	8	4	20
II	Thyristor Protection Firing Circuits & Commutation Techniques	08	4	2	4	10
III	Phase Controlled Rectifier	10	2	4	4	10
IV	Choppers	10	-	4	6	10
V	Inverters	10	2	4	6	12
VI	Industrial Control Circuits	08	-	4	4	08
TOTAL		**64**	**16**	**26**	**28**	**70**

R Remembering, U Understanding, A Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mrs Pooja Nikhade
2	Internal	Mr. N D Adate
3	External	Mr. Vinod Yadav
		Organisation: Premlila Vithaldas Polytechnic, SNDT, Mumbai

1. COURSE DETAILS

Programme: Electrical Engineering	**Semester: IV**
Course: #Electrical Contracting & Estimation	**Group: A**
Course Code: ECE220313	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks							
Theory Hrs. L	Practical Hrs. P	Drawing Hrs. D	Tutorial Hrs. T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
04	-	02	-	06	03	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE

Electrical Diploma holders have to work as Technicians & Supervisors for Electrical Installations of various companies, commercial and Industrial electrification schemes and prepare estimates for these schemes. They also work as Independent electrical contractors and execute illumination and electrification schemes. This course will help them to prepare detailed estimates.

4. SKILL COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences:

- **Design electrical installation with costing for tendering**

5. COURSE OUTCOMES (COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Follow National Electrical Code 2011 in electrical installations
CO2	Prepare tender and quotation of various installations
CO3	Estimate the work of Residential Installation
CO4	Estimate the work of Commercial Installation
CO5	Estimate the work of Industrial Installation
CO6	Estimate the work of public lighting Installation

6. CO - PO, CO - PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Electrical Contracting & Estimation (ECE220313)	CO1	3	1	1	2	-	-	-	2	2
	CO2	1	-	3	-	2	-	-	3	3
	CO3	1	2	3	-	-	-	-	3	3
	CO4	1	2	3	-	-	-	-	3	3
	CO5	1	2	3	-	-	-	-	3	3
	CO6	1	2	3	-	-	-	-	3	3
	CO Avg	**1.33**	**1.80**	**2.67**	**2**	**2**	**-**	**-**	**2.83**	**2.83**

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-Topic	CO
I	**1.0 Electrical Installation and Drawing** 1.1 Scope and features of National electric code 2011 1.2 General requirement of Electrical installation 1.3 Types of electrical installation 1.4 Reading and Interpretation of Electrical Engineering Drawings 1.5 Various diagrams, plans and layout	CO1
II	**2.0 Estimation and Costing** 2.1 Meaning and purpose of rough estimate, detailed estimate, supplementary estimate, annual maintenance estimate and revised estimate 2.2 Factors to be considered while preparation of detailed estimate and economical execution of work 2.3 Contracts- Concepts of contracts, types of contracts, contractor, Criteria for selecting Contractor, role of contractor 2.4 Tenders and Quotations- Type of tender, tender notice, preparation of tender document, and procedure of opening of tendering documents 2.5 Comparative statements 2.6 Principles of execution of work, need of planning for the execution of work	CO2
III	**3.0 Residential Building Installation** 3.1 General rules guidelines for wiring of Residential Installation and positioning of equipment	CO3

	3.2 Principles of circuit design in lighting and power circuits 3.3 Procedures for designing the circuits and deciding the number of circuits 3.4 Method of drawing single line diagram 3.5 Selection of type of wiring and rating of wires & cables 3.6 Load calculations and selection of size of conductor 3.7 Selection of rating of main switch, distributions board, protective switchgear ELCB, MCB and wiring accessories. 3.8 Earthing of Residential Installation. Plate and pipe earthing. 3.9 Sequence to be followed for preparing Estimate. 3.10 Preparation of detailed estimates and costing of Residential Installation	
IV	**4.0 Commercial Installation** 4.1 Concept of commercial Installation 4.2 Differentiate between electrification of Residential and commercial Installation 4.3 Fundamental considerations for planning of an electrical Installation system for commercial building 4.4 Design considerations of electrical Installation system for commercial building 4.5 Load calculations & selection of size of service connection and nature of supply 4.6 Deciding the size of cables, bus bar and bus bar chambers 4.7 Mounting arrangements and positioning of Switchboards, distribution boards, main switch etc. 4.8 Earthing of the electrical Installation 4.9 Selection of type of wire, wiring system & layout 4.10 Sequence to be followed to prepare estimate 4.11 Preparation of detailed estimate and costing of commercial Installation	CO4
V	**5.0 Industrial Installation** 5.1 Concept of Industrial load 5.2 Concept of Motor wiring circuit and single line diagram 5.3 Important guidelines about power wiring and Motor wiring 5.4 Design consideration of Electrical Installation in small Industry/Factory/workshop 5.5 Motor current calculations 5.6 Selection and rating of wire, cable size & conduct 5.7 Deciding fuse rating, starter, distribution boards, main switch etc. 5.8 Deciding the cable route, determination of length of wire, cable, conduit, earth wire, and earthing 5.9 Sequence to be followed to prepare estimate. 5.10 Preparations of detailed estimate and costing of small factory unit/ workshop.	CO5

VI	**6.0 Public Lighting Installation** 6.1 Classification of outdoor installations streetlight/ public lighting installation 6.2 Street light pole structures. Selection of equipments, sources used in street light installations. 6.3 Cables, recommended types and sizes of cable. Control of street light installation. 6.4 Design, estimation and costing of streetlight	CO6

8. **LIST OF DRAWING SHEETS:** Term Work consists of minimum number of Five Drawing Sheets and assignments from the following

Sr. No.	Title of Drawing Sheet	Approx.Hrs required	CO
1.	Different Types of Electrical Symbols and wiring diagrams	4	CO1
2.	Prepare a quotation for purchasing different electrical material required.	4	CO2
3.	Electrical Installation scheme for single flat, independent bungalow and small house. Draw wiring diagram and prepare detailed estimate and its costing	8	CO3
4.	Electrical Installation scheme for commercial buildings. Draw wiring diagram and prepare detailed estimate and its costing	8	CO4
5.	Electrical Installation scheme for small factory unit. Draw single line layout and prepare detailed estimate and its costing 1) Small factory unit 2) Workshop 3) Agriculture pump and flour mills	4	CO5
6	Estimate with a proposal of the electrical Installation of streetlight scheme for small premises after designing	4	CO6
	Total	32	
	Assignments- 1. Draw different types of wiring Systems 2. Explain in detail Contracts and Tenders	- -	CO1 CO6

9. **TEACHERS ASSESSMENT (TA):** Assessment to be based on one of the following tools and rubrics for evaluation of TA to be well defined by course teacher
   1. Micro project
   2. Seminar/Presentation
   3. Model/Chart making
   4. Surveys
   5. Case Study
   6. Quiz

10. IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan
2. Minimum no of drawings.
3. Industry visit
4. Guest/Expert lectures
5. Slides
6. Group discussions
7. Self Learning Online Resources

11. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of the Book	Author	Publication
1	Electrical Design Estimating and costing	K.B. Raina	New Age International
2	Electrical Estimating and costing	Surjit Ravi Deep Singh	Dhanpat Rai & Sons
3	Electrical Estimating and costing	Allagappan, N.S.Ekambarram	Tata Mc-Graw Hill
4	Electrical Design Estimating and costing	S.L.Uppal	Khanna Publication

12. WEB REFERANCES

1. www.electricalinstallation.com
2. www.totalestimating.com
3. www.electriciantalk.com
4. www.electriciansforums.net
5. www.electrical4u.com

13. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Electrical Installation and Drawing	08	04	04	02	10
II	Estimation and Costing	10	02	04	06	12
III	Residential Building Installation	14	04	04	08	16
IV	Commercial Installation	12	02	04	06	12
V	Industrial Installation	12	02	04	06	12
VI	Public Lighting Installation	08	02	04	02	08
TOTAL		**64**	**16**	**24**	**30**	**70**

R- Remembering, U- Understanding, A- Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

SR.NO.		NAME
1	Internal	Mr. Dinesh G Rajmandai
2	Internal	Mr. N D Adate
3	External	Shri.A.K Dhulshette
		Organization: Government Polytechnic, Mumbai

1. COURSE DETAILS

Programme: Electrical Engineering	**Semester: IV**
Course: # DC & Synchronous Machines	**Group: C**
Course Code: DSM220314	**Duration: 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
04	02	--	--	06	03	70	20	10	70	50	50	--	200

3. COURSE OBJECTIVE

This Course deals with the study of DC Machines, Alternator, Synchronous Motor and practical's thereof. In order to understand Electrical testing & maintenance, Traction and Drives, Power Electronics knowledge of DC & Synchronous Machines is very important.

4. SKILL COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences.

- **Use relevant DC Machines and Synchronous machines for different electrical engineering applications.**

5. COURSE OUTCOMES (COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Explain the various types, constructional details and characteristics of D.C Generator
CO2	Describe the various types, constructional details and characteristics of D.C Motor
CO3	Calculate losses and efficiency of D.C Generator and Motor
CO4	Use the relevant three phase alternator for different load conditions.
CO5	Conduct parallel operation of three phase Alternator.
CO6	Use suitable Synchronous motors in different applications.

6. CO - PO, CO - PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#DC & Synchronous Machines (DSM220314)	CO1	3	1	-	2	-	-	-	2	2
	CO2	3	1	-	2	-	-	-	2	2
	CO3	3	2	1	1	-	-	-	3	3
	CO4	2	2	3	1	-	-	1	3	3
	CO5	2	2	1	3	-	-	-	3	3
	CO6	2	2	3	1	-	-	1	3	3
	CO Avg	**2.5**	**1.67**	**2.0**	**1.67**	**-**	**-**	**1.0**	**2.67**	**2.67**

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic	CO
I	**1.0 D.C generator** 1.1 Introduction of D.C Machines 1.2 Principle of operation & construction of Generator. 1.3 Armature winding (Only Basics) 1.4 E.M.F equation of D.C Generator. (Simple Numericals) 1.5 Types of DC generators 1.6 DC generators characteristics 1.6.1 Open circuit characteristics 1.6.2 External characteristics 1.6.3 Internal characteristics 1.7 Building up process of dc shunt generator. Critical field resistance, critical speed.	CO1
II	**2.0 D.C Motor** 2.1 Principle of operation and Construction of D.C motor. 2.2 Back emf & torque equation of dc Motor 2.3 Types of dc motors. 2.4 Characteristics and Applications of dc motors 2.5 Method of speed control of dc shunt and series motors. 2.6 Starting of dc motors : 2.6.1 Three Point and 2.6.2 Four-point dc shunt motor starter. 2.7 Simple Numericals based on above topics.	CO2

	2.8 Brushless DC Motor (Construction, working principle, advantages and applications)	
III	**3.0 Losses & efficiency in dc machines** 3.1 Power losses in dc machines 3.2 Power flow diagram 3.3 Efficiency of dc motor and DC generator 3.4 Derivation of condition for maximum efficiency of dc motor and DC generator. 3.5 Simple Numericals based on above topics.	CO3
IV	**4.0 Three phase alternators.** 4.1 Construction of synchronous machine and its working principle. 4.2 Concept of synchronous speed. 4.3 Salient pole & non-salient pole type field structure. 4.4 Classification of stator armature winding. Single and Double layer. 4.5 Emf equation of Alternator with numerical by considering Short pitch factor and Distribution factor. 4.6 Phasor diagrams of alternator on various load. 4.7 Synchronous Impedance and its determination by open and short circuit test. 4.8 Voltage regulation of an alternator by direct loading and synchronous impedance method. 4.9 Simple numericals based on the above topics	CO4
V	**5.0 Parallel operation of Three Phase Alternators** 5.1 Necessity of Parallel operation of three phase alternators 5.2 Conditions or requirements of Parallel operation of three phase alternators 5.3 Methods of parallel operation of three phase alternators 5.3.1 Three dark lamp method 5.3.2 Two bright and one dark lamp method 5.3.3 Synchroscope method	CO5
VI	**6.0 Synchronous motors** 6.1 Principle and operation of Synchronous motor 6.2 Starting torque, running torque, pull in torque, pull out torque 6.3 Effect of load on synchronous motor with constant excitation 6.4 Behavior of synchronous motors with constant load and variable excitation 6.5 Hunting and phase swinging 6.6 Starting methods of synchronous motor 6.7 V- curves and Inverted V- curves 6.8 Applications of Synchronous motor	CO6

8. LIST OF PRACTICALS/ASSIGNMENTS/TUTORIALS/DRAWINGS

Term work consist of Journal containing minimum number of 10 Experiments/assignments/drawings

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs required	CO
1	To Plot the characteristics of a dc shunt generator on Load	4	CO1
2	To Plot the characteristics of a dc series generator on Load	4	CO1
3	To Plot Magnetization curve of a dc generator and determination of critical field resistance.	2	CO1
4	To Plot Speed V/S load characteristics of a dc shunt motor.	4	CO2
5	Speed Control of DC shunt Motor by Armature Rheostatic control method	2	CO2
6	Study of Brushless D.C Motor	2	CO2
7	Speed Control of DC shunt Motor by flux control method	2	CO2
8	Assignment – Condition of maximum efficiency of DC Motor and DC Generator	-	CO3
9	To Plot open circuit Characteristics of an Alternator	2	CO4
10	To Plot Short Circuit Characteristics of an Alternator	2	CO4
11	Determination of regulation & efficiency of an alternator from open circuit & short circuit characteristics	4	CO4
12	Parallel operation of three phase Alternators	2	CO5
13	To Plot V and inverted V curve of a synchronous motor	2	CO6
	TOTAL	**32**	

9. TEACHERS ASSESSMENT (TA): Assessment to be based on one of the following tools and rubrics for evaluation of TA to be well defined by course teacher

1. Micro project
2. Seminar/Presentation
3. Model/Chart making
4. Surveys
5. Case Study
6. Quiz

10. IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan.
2. Minimum number of practicals/Assignments.
3. Industry visit.
4. Guest/Expert lectures.

5. Demonstrations.
6. Slides.
7. Self-Learning Online Resources

11. SUGGESTED LEARNING RESOURSES

Sr.	Title of Book	Author	Publication
1	Electrical Technology Volume – II	B.L.Theraja	S.Chand and Co. New Delhi.
2	Electrical Machines	S.K.Bhattacharya	Tata McGraw Hill Pub Co.Ltd. New Delhi.
3	Electrical Machinery	P.S.Bhimra	Khanna Publishers
4	Elements Of Electrical Machines	Pradip Kumar Sadhu	CBS Publications
5	Electrical Machines –II	J B Gupta	S.K. Kataria & Sons ISBN 10: 9350141604 ISBN 13: 9789350141601
6	Fundamentals of Electric Machines	B R Gupta	New Age International (P) Ltd. ISBN: 9788122416145

12. WEB REFERENCES

1) http://www.nptel.ac.in/courses/108105017
2) www.electricaltechnology.org
3) www.electrical4u.com
4) http://www.electricaleasy.com
5) http://www.youtube.com/watch?v=D4RFFnzRdkk

13. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	D.C generator	12	5	5	3	13
II	D.C Motor	14	5	6	4	15
III	Losses & efficiency in dc machines	08	3	3	3	09
IV	Three phase Alternators	10	4	4	3	11
V	Parallel operation of Three phase Alternators	08	3	3	3	09
VI	Synchronous motors	12	5	5	3	13
TOTAL		**64**	**25**	**26**	**19**	**70**

R- Remembering, U - Understanding, A- Applying (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs.The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

SR.NO.		NAME
1	Internal	Mr.Dinesh G Rajmandai
2	Internal	Mr.N.D.Adate
3	External	Shri.A.K.Dhulshette
		Organisation: Government polytechnic, Bandra.

1. **COURSE DETAILS**

Programme: Electrical Engineering	**Semester: IV**
Course: Utilization of Electrical Energy	**Group: A (Elective-I)**
Course Code: UEE220315	**Duration: 16 Weeks**

2. **TEACHING AND EXAMINATION SCHEME**

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D +T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
4	2	-	-	6	3	70	20	10	70	25	-	50	175

3. **COURSE OBJECTIVE**

Electrical Engineering diploma holders are appointed in industries in the supervisory cadre. Their main job functions are to supervise the operation and control of various electrical furnaces, electrical welding equipment, refrigeration, air-conditioning systems. The factory illumination scheme is also to be maintaining by them. Also, nowadays they are responsible to conserve energy and reduce the bills and environmental impact of various processes. Therefore, the knowledge of operation and control of these machines and equipment is vital for every diploma holder.

4. **SKILL COMPETENCY**

The aim of this course is to help the student to attain following competency through various teaching-learning experiences:

- **Suggest the appropriate method/scheme for illumination, heating, welding and techniques for conserving energy while utilizing electrical energy for various applications.**

5. **COURSE OUTCOMES (COs) at the end of the semester student will be able to: -**

CO No.	COURSE OUTCOME
CO1	Select appropriate type, rating, number of light source and lighting scheme for indoor lighting as per given specifications/requirement.
CO2	Select suitable method of electric heating and welding for various applications.
CO3	Determine the appropriate methods to improve energy efficiency in compressors, pumps, refrigeration and HVAC systems.
CO4	Justify the need of energy conservation and hence energy audit.
CO5	Determine appropriate energy conservation techniques and devices in motors, transformers, illumination and transmission-distribution.
CO6	Estimate tariff, its applicable tariff and methods to reduce the same.

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Utilization of Electrical Energy (UEE220315)	CO1	3	2	3	1	1	-	1	2	3
	CO2	3	2	1	1	1	-	1	2	3
	CO3	3	3	1	1	1	-	1	2	3
	CO4	3	2	1	1	3	1	1	2	3
	CO5	3	2	1	-	3	-	1	2	3
	CO6	3	3	2	1	1	-	1	2	3
	CO Avg.	**3.00**	**2.33**	**1.50**	**1.00**	**1.66**	**1.00**	**1.00**	**2.00**	**3.00**

7. COURSE CONTENTS

UNIT NO.	Topic /Sub-Topics	CO
I	**Illumination:** 1.1 Definitions of terms used in illuminations: Light, Luminous flux, luminous intensity, Lumen, Candle power, illumination, lux or meter candle, mean horizontal candle power (MHCP), means spherical candle power (MSCP), means hemispherical candle power (MHSCP), Reduction factor, lamp efficiency, specific consumption, glare, space to height ratio, utilization factor, maintenance factor, depreciation factor, waste light factor, absorption factor, reflection factor, plane angle, solid angle. 1.2 Laws of illumination 1.2.1 Law of inverse squares. 1.2.2 Lambert's cosine law 1.3 Sources of light Construction, working and application of following lamps: LED lamps 1.4 Types of indoor lighting schemes 1.5 Design of indoor lighting schemes 1.5.1 Objectives of lighting scheme 1.5.2 Factors to be considered while designing the lighting scheme 1.6 Lighting calculations (simple numerical) 1.7 Street lighting, public lighting	CO1
II	**Electrical heating & welding:** 2.1 Concept of Electric Heating, Classification of electric heating, Advantages and disadvantages, Modes of heat transfer 2.2 Resistance heating: Direct and indirect resistance heating, their working	CO2

	principle and construction, Properties of heating element material, Causes of failure of heating element, methods of temperature control, application of resistance heating, Advantages and disadvantages (No numerical) 2.3 Arc heating: Direct arc heating, indirect arc heating, applications of arc heating, Advantages and disadvantages 2.4 Induction heating. Core type induction furnaces- Ajax Wyatt furnace, coreless induction furnace, Application of induction heating, Advantages and disadvantages 2.5 Dielectric heating- Principle, application of dielectric heating, Advantages and disadvantages 2.6 Electric welding, Advantages, Classifications 2.7 Resistance welding 1.7.1 Principle of resistance welding, Advantages and disadvantages 1.7.2 Types of resistance welding and their applications 1.7.3 Quality of good weld, welding defects 2.8 Arc welding Machines: Principle and operation, Metal arc welding, Carbon arc welding, Advantages of coated electrodes, Supply (AC/DC), applications, Arc Welding Machines, AC Welding Machines – Welding Transformer.	
III	**Refrigeration and HVAC:** 3.1 Refrigeration cycle, difference between refrigeration and air conditioning 3.2 Basic block diagram of HVAC 3.3 Function of compressors 3.4 Types of compressors 3.5 Compressed air system components 3.6 Function of pumps & Working of Centrifugal 3.7 Energy efficiency in HVAC and refrigeration	CO3
IV	**Energy Conservation:** 4.1 Preset energy scenario. 4.2 Energy Conservation: Definition, Importance of energy conservation 4.3 Energy Conservation Act – 2003. 4.4 Bureau of Energy Efficiency and its functions 4.5 Energy audit (only introduction)	CO4
V	**Energy conservation techniques in electric systems:** 5.1 Electrical Motors: Types, Energy Efficient Motors, Factors affecting efficiency of motors 5.2 Energy Efficient Transformer 5.3 Energy Efficient Lighting and Control 5.4 Losses in Transmission and Distribution System and its Minimization 5.5 Reactive Power Compensation 5.6 Demand Side Management System	CO5
VI	**Economic aspects of utilizing electrical energy** 6.1 Costing of electrical energy: fixed charge, Semi fixed charge & running Charge.	CO6

	6.2 Various types of tariff: Simple tariff, Flat rate tariff, Block rate tariff, two-part tariff, Maximum demand tariff and Power factor tariff, Time of day tariff, Availability Based tariff 6.3 Types of consumers and their Tariffs: Domestic, Commercial, Agricultural and Industrial consumers. (Simple numerical on Tariffs) 6.4 Power factor improvement: causes of low power factor, disadvantage of Low power factor, Methods of power factor improvement 6.5 Most economical power factor (Derivation and simple numerical)	

8. LIST OF PRACTICALS/ASSIGNMENTS/EXERCISES/TUTORIALS/DRAWINGS

The term work consists of journal consisting of minimum 5 assignments and mini project/study project/industry visit with approximate number of hours required with corresponding CO's

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs. required	CO
1	Measurement of illumination by lux meter for different locations and of different lamps, Assignment on Illumination laws and numerical	2	CO1
2	Assignment on Electric Heating, welding	2	CO2
3	Assignment on Refrigeration and HVAC	2	CO3
4	Preparation of a detailed energy audit report of a house/site	4	CO4
5	Determination of various parameters in electricity bill of domestic and industrial consumers and suitable methods/means for conservation of electricity	2	CO5/CO6
6	Estimation of energy conservation by improving power factor for given cases	4	CO6
7	Mini project/Study project/Project based on Industry visit	16	CO1/CO2/CO3/ CO4/CO5/CO6
	Total Hours	**32**	

9. TEACHERS ASSESSMENT (TA):

Assessment to be based on one of the following tools and rubrics for evaluation of TA to be well defined by course teacher.

1. Micro-Project
2. Seminar/Presentation
3. Model/Chart making
4. Surveys
5. Case Study
6. Quiz

10. IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan.
2. Assignments.
3. Industrial visit.
4. Guest/Expert lectures.
5. Continuous assessment.
6. Slides.
7. Any other method adopted.

11. SUGGESTED LEARNING RESOURSES

Sr. No.	Title of Book	Author	Publication
1	Art & science of utilization of electric energy	H Partab	Dhanpat rai & sons
2	Utilization of electric power & electric traction	J.B Gupta	S.K kataria & sons
3	Utilization of electric power & electric traction	G.C Garg	Khanna Publishers
4	General aspects of Energy Management and Energy Audit	Bureau of Energy efficiency	Bureau of Energy efficiency
5	Energy efficiency in Electrical Utilities	Bureau of Energy efficiency	Bureau of Energy efficiency
6	Generation, Distribution and Utilization if Electrical	CL Wadhwa	Wiley Eastern Ltd. New Delhi.

12. WEB REFERENCES

1. https://beeindia.gov.in/en
2. https://nptel.ac.in/
3. https://www.adeetie.beeindia.gov.in/
4. www.khanacademy.com
5. https://www.ijert.org/research/utilization-of-electrical-energy-its-recent-advancements-IJERTV8IS020107.pdf

13. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Illumination	12	3	4	6	13
II	Electrical heating & welding	12	3	3	5	11
III	Compressors, pumps, Refrigeration and HVAC	09	3	6	4	13
IV	Energy Conservation	04	3	4	-	07
V	Energy conservation techniques in electric systems	15	3	4	6	13
VI	Economic aspects of utilizing electrical energy	12	3	4	6	13
TOTAL		**64**	**18**	**25**	**27**	**70**

R Remembering, U Understanding, A Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

SR. No.		NAME
1	Internal	Ms. Urvi H. Sawant
2	Internal	Mr. Dinesh G. Rajmandai
3	External	Mrs. Ashwini Patil
		Organization: Government Polytechnic, Mumbai

1. COURSE DETAILS

Programme: Electrical Engineering	**Semester: IV**
Course: Renewable Energy Sources	**Group: A (Elective- I)**
Course Code: RES220316	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	**Practical Hrs P**	**Drawing Hrs D**	**Tutorial Hrs T**	**Credits (L+P+D+T)**	**Theory Paper Duration and marks (ESE)**		**SSL**	**TA**	**TH**	**TW**	**PR**	**OR**	**TOTAL**
					Hours	**Marks**							
4	2	-	-	6	3	70	20	10	70	25	-	50	175

3. COURSE OBJECTIVE

This is a core technology subject. Electrical diploma pass outs should know the principle of generation of electricity using renewable energy sources, their environmental impact and recent trends in power.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain following competency through various teaching-learning experiences:

- **Suggest the appropriate method of power generation for given application.**

5. COURSE OUTCOMES (COs) at the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Justify the use of renewables considering adverse environmental effects due to non-renewable energy sources.
CO2	Recommend the methods of utilizing solar energy for power generation.
CO3	Select site and type of the plant suitable for harvesting Geothermal, Biomass and Ocean energy.
CO4	Select site and type of the plant suitable for harvesting Wind and energy.
CO5	Recommend the use of Fuel cell and Hydrogen energy for specific application.

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Renewable Energy Sources (RES220316)	CO1	3	1	-	-	3	-	1	3	1
	CO2	3	1	1	3	2	-	1	3	3
	CO3	3	-	-	-	3	-	1	3	2
	CO4	3	1	1	3	2	-	1	3	3
	CO5	3	1	1	-	3	-	1	3	2
	CO Avg.	**3.00**	**1**	**1**	**3.00**	**2.60**	**-**	**1.00**	**3.00**	**2.20**

7. COURSE CONTENT

UNIT NO.	Topic/Subtopic	CO
I	**Environmental issues of non-renewable energy sources** 1.1. Review of conventional and non-conventional energy sources 1.2. Environmental Impact of non-renewable sources 1.3. Green House effect, Acid rain, Pollution, Smog, Nuclear Radiation 1.4. Kyoto Protocol 1.5. Carbon credits	CO1
II	**Solar Energy** 2.1 Potential of Solar energy 2.2 Merits and demerits 2.3 Solar Thermal Energy Conversion 2.4 Collectors- Flat plate, Focusing 2.5 Photovoltaic effect 2.6 Solar cell: Construction, working, material, I-V and P-V characteristic, tilt angle, Module, Panel and Array Components of off-grid, standalone solar system On-grid solar energy system 2.7 Merits and demerits	CO2
III	**Wind Energy** 3.1 Principle of Electricity Generation with the help of Wind Energy 3.2 Selection of sites for Wind Mills and Environmental Impact 3.3 Types of Wind mills: Horizontal Axis and Vertical Axis Wind Turbine 3.4 Block diagram and working of Wind energy plant 3.5 Recent development: Yaw control, Pitch control, Variable speed drive 3.6 Generators is wind turbine 3.7 Status of Wind Energy in India	CO3

IV	**Other renewable energy sources** 4.1 **Geothermal Energy**: Geothermal Energy Resources, Electricity Generation using Geothermal Energy, Merits and demerits 4.2 **Ocean Energy:** • Ocean Thermal Electric conversion- Working, Merits and Demerits, • Operation of Tidal Power Plant, Advantages, Limitations, Site requirements, Environmental Impact, Potential sites in India 4.3 **Bio-mass & Bio-gas energy:** Bio-fuels, Biomass resources, Biomass conversion techniques, Merits and demerits, Energy Plantation	CO4
V	**Recent Trends in Electricity Generation (only concept and advantages)** 5.1 **Fuel Cell:** Construction and working, Applications, Merits and Demerits 5.2 **Hydrogen Energy:** Properties of Hydrogen, Production methods, Safety issues, Energy conversion of Hydrogen, Application	CO5

8. LIST OF PRACTICALS /ASSIGNMENTS/ EXERCISES/ TUTORIALS/ DRAWINGS

Term Work consists of Journal containing minimum 10 experiments

Sr. No.	Title of experiments	Approx. Hours required	CO
1	Study environmental impact by non-renewable energy sources	2	CO1
2	Demonstrate the I-V and P-V characteristics of PV module with varying radiation and temperature level	2	CO2
3	Demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules	2	CO2
4	Observe the effect of variation in tilt angle and shading on module output power	4	CO2
5	Calculation of power flow in stand-alone PV system with load	4	CO2
6	Evaluation of cut-in speed of wind turbine experimentally	4	CO2
7	Plotting wind power versus wind speed curve	4	CO3
8	Evaluation of coefficient of performance of wind turbine	4	CO3
9	Study existing geothermal/ ocean/ biomass power plants in the world.	2	CO4
10	Study any one recent trends in electricity generation	2	CO5
11	Study of fuel cell and hydrogen energy in power generation	2	CO5
	Total	**32**	

9. TEACHER'S ASSESSMENT (TA):

Assessment to be based on one of the following tools and rubrics for evaluation of TA to be well defined by course teacher.

1. Micro-Project
2. Seminar/ Presentation
3. Model/Chart making
4. Surveys
5. Case Study
6. Quiz

10. IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan
2. Minimum no of practical/assignments.
3. Industry visit
4. Guest/Expert lectures
5. Demonstrations
6. Slides
7. Self-Learning Online Resources Any other method adopted

11. SUGGESTED LEARNING RESOURCES:

Sr. No.	Title	Author	Publisher
1	A course in Electrical Power	J. B. Gupta	S. K. Kataria & Sons
2	Power Plant Engineering	P. K. Nag	McGraw Hill Education (India)
3	Electrical Power	Dr. S. L. Uppal	Khanna Publishers.
4	Non-conventional Energy sources	Prof. G. D. Rai	Khanna, New Delhi
5	Non-conventional Energy sources	G. S. Sawhney	PHI Learning Pvt Ltd

12. WEB REFERENCES:

1. http://www.mnre.gov.in/11
2. https://www.ireda.in/home
3. https://www.makeinindia.com/sector/renewable-energy
4. https://www.energy.gov/eere/renewable-energy
5. https://www.edfenergy.com/

13. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	UNIT TITLE	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Environmental issues of non-renewable energy sources	04	4	-	-	04
II	Solar Energy	20	3	10	8	21
III	Wind Energy	16	3	6	8	17
IV	Other renewable energy sources	14	3	4	8	15
V	Recent Trends in Electricity Generation	10	3	4	6	13
Total		**64**	**16**	**24**	**30**	**70**

R Remembering, U Understanding, A Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Ms. Urvi Sawant
2	Internal	Mr. Dinesh G. Rajmandai
3	External	Mrs. Ashwini Patil
		Organization: Government Polytechnic, Mumbai

1. COURSE DETAILS:

Programme: Electrical Engineering	**Semester: IV**
Course: Energy Audit & Conservation	**Group: A (Elective-I)**
Course Code: EAC220317	**Duration: 16 Weeks**

2. TEACHING & EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks							
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
04	02	--	--	06	03	70	20	10	70	25	-	50	175

3. COURSE OBJECTIVE

This course is categorized under technology subjects, Rapid Developments in the standard of living of countrymen results into increased energy consumption. But due to limited availability of conventional sources and difficulties in their tapping and uneconomical and insufficient R and D aspect of non-conventional sources, energy conservation is the most important tool to some extent, to face the problem of the increased demand. Hence electrical engineers must have knowledge of various methods of energy conservation and concept of energy audit and its implementation.

4. SKILL COMPETENCY:

The aim of this course is to help the students to attain the following industry identified competency through various teaching leaning experiences

- **Carry out energy audit of small, medium and large organisation and recommend suggestions for power saving**

5. COURSE OUTCOMES (COs At the end of the semester students will be able to:-

CO.NO	COURSE OUTCOMES
CO1	List causes for limited growth of conventional energy sources and limitations of non-conventional sources of energy.
CO2	Apprise the connect between energy and environment
CO3	Carry out energy audit and Prepare report of energy audit
CO4	Recommend methods of energy conservation for different load conditions.
CO5	Implement energy efficient technologies for electrical systems
CO6	Select appropriate tariff system and methods for reducing electricity consumption and energy saving.

6. CO- PO, CO - PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Energy Audit & Conservation (EAC220317)	CO1	2	1	-	-	3	-	1	2	2
	CO2	2	-	1	-	3	-	1	2	2
	CO3	2	-	2	-	-	3	1	2	3
	CO4	2	3	-	2	-	-	1	3	3
	CO5	3	2	-	3	-	2	-	3	3
	CO6	2	2	3	-	-	-	1	3	3
	CO Avg.	**2.17**	**2.00**	**2.00**	**2.50**	**3.00**	**2.50**	**1.00**	**2.50**	**2.67**

7. COURSE CONTENTS

UNIT NO.	Topic/Sub-Topics	CO
I	**1.0 Energy Conservation Scenario** 1.1 Introduction: Primary -Secondary Energy, Commercial, Non-Commercial Energy 1.2 Global Primary Energy Resources 1.3 Global Consumption, Energy Distribution 1.4 Energy Supply: Coal, Oil, Electricity, Nuclear, Hydro 1.5 Scope for energy conservation 1.6 Objectives of Energy conservation 1.7 Reforms in Coal, Natural Gas and Electricity	CO1
II	**2.0 Energy & Environment** 2.1 Environment and Social Concerns Related to Energy Utilisation 2.2 Green House Effect 2.3 Global Warming and Its effects 2.4 Pollution, Acid Rains 2.5 Global Energy and Environment Management	CO2
III	**3.0 Energy Management and Audits** 3.1 Definition, Objectives of Energy Management 3.2 Types of Audit 3.2.1 Preliminary Audit objective and Procedure 3.2.2 Detailed Audit objective and Procedure 3.3 Energy audit instruments & their use 3.4 ABC analysis 3.5 Questionnaire for energy audit projects 3.6 Energy flow diagram or Sankey Diagram 3.7 Energy Management: Key Elements, Perspective, Contents Organising 3.8 Roles & responsibilities of Energy Manager 3.9 Roles & responsibilities of Energy Auditor 3.10 Energy Audit Report format	CO3

IV	**4.0 Energy Efficiency & Energy Conservation in Electrical Utility** 4.1 Introduction to Electrical Power Supply System 4.2 Electrical Load Management 4.3 Electrical Motors: Types, Energy Efficient Motors, Factor Effecting Motor Efficiency 4.4 Lighting System, Choice of Lighting, Energy Efficient Lighting Energy Saving Opportunity 4.5 Reactive Power Compensation, Demand Side Management System 4.6 Losses in Transmission and Distribution System and Its Minimization 4.7 HVAC and Refrigeration System, Selection of Suitable Refrigeration System	CO4
V	**5.0 Energy Efficient Technology in Electrical System** 5.1 Maximum Demand Controller 5.2 Automatic Power Factor Controllers 5.3 Energy efficiency in Electrical Machines 5.3.1 Energy efficient motors 5.3.2 Soft Starter 5.3.3 Static Capacitors 5.3.4 Automatic star delta converters 5.3.5 Variable Frequency Drive 5.4 Amorphous core distribution transformers 5.5 Dry type/Epoxy resin cast type transformer 5.6 Energy Efficient Lighting Control	CO5
VI	**6.0 Energy Conservation through Cogeneration and Tariff** 6.1 Co-Generation and Tariff: Concept, significance for energy conservation 6.2 Co-Generation: Types of cogenerations on the basis of 6.2.1 Sequence of energy use (Topping Cycle and Bottoming Cycle) 6.2.2 Basis of Technology (Steam turbine cogeneration, Gas turbine cogeneration and Reciprocating engine cogeneration) 6.3 Factors governing the selection of cogeneration systems 6.4 Advantages of cogeneration 6.5 Tariff: Types of tariff structure 6.5.1 LT & HT, Special Tariff, 6.5.2 Time of Day (TOD), Peak of Day Tariff, 6.5.3 Power Factor Tariff, Maximum Demand Tariff, 6.5.4 Load factor Tariff and Availability based tariff 6.6 Applications of tariff system to reduce energy bill	CO6

8. LIST OF PRACTICALS/ASSIGNMENTS/TUTORIALS/DRAWINGS

Term work consist of Journal containing minimum number of 8 Experiments/assignments/drawings

Sr. No.	Title of Experiment/Assignments/Exercise/Tutorial/drawings	Approx. Hrs required	CO
1	Identify star labelled electrical apparatus and compare the data for various star rating	2	CO1
2	Assignment on impact of global warming and its effects	-	CO2
3	Prepare a simple energy audit questionnaire for the given industrial facility	2	CO3
4	Prepare an energy audit report (phase-I, II and III) for any given case	4	CO3
5	Compare power consumption of different types of TL with choke , Electronic Ballast and LED Lamps	2	CO4
6	Determine the % loading along with the related efficiency for different loads of given induction motor (20 to 110 % in steps of 10 %)	2	CO5
7	Determine the reduction in power consumption in star mode operation of induction motor compared to delta mode	2	CO5
8	Use of APFC unit for improvement of power factor of electrical load	2	CO5
9	Collect electricity bills of an industrial consumer and suggest suitable tariff for conservation and reduction of its energy bill	4	CO6
10	Collect electricity bills of commercial consumer and suggest suitable tariff for conservation and reduction of its energy bill	4	CO6
11	Collect electricity bills of residential consumer and suggest suitable tariff for conservation and reduction of its energy bill	4	CO6
12	Estimate the energy saving by improving power factor and load factor for a given cases	4	CO6
	Total	**32**	

9. TEACHERS ASSESSMENT (TA): Assessment to be based on one of the following tools and rubrics for evaluation of TA to be well defined by course teacher

1. Micro project
2. Seminar/Presentation
3. Model/Chart making
4. Surveys
5. Case Study
6. Quiz

10. IMPLEMENTATION STRATEGY (PLANNING):

1. Teaching Plan
2. Minimum no. of practicals/assignments
3. Industrial Visits
4. Guest/Expert Lectures
5. Demonstrations
6. Self-Learning Online Resources

11. SUGGESTED LEARNING RESOURSES

Sr. No.	Title of Book	Author	Publication
1	Guide books no.1 to 4 for National Certification examination for Energy Managers &Energy auditors	Bureau of Energy Efficiency (BEE)	Bureau of Energy Efficiency (Forth Edition 2015)
2	Energy Resources &Management	Renu Dhupper	Cbs Publication ISBN - 978812392575
3	Energy management & Conservation	K V Sharma P Venkataseshaiah	I.K. International Publishing House Pvt. Ltd. ISBN:978-93-81141-29-8
4	Energy Management	Umesh Rathore	SK Kataria& Sons ISBN 978-93-5014-101-4
5	Electrical Energy Conservation & Auditing	Er. Udit Mamodiya	Ashirwad Publication ISBN -139788194250692
6	Power Factor Correction Management & Energy Audit	Siemens	New Age Vol.38 2005

12 WEB REFERENCES

1. https://beeindia.gov.in/
2. https://www.mahaurja.com/
3 www.nptel.ac.in
4. https://www.worldenergy.org/
5. https://www.electricalindia.in/energy-management-and-conservation/
6. https://www.technicalbookspdf.com/power-electronics-handbook-fourth-edition/

13. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

UNIT No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Energy Scenario	08	2	2	4	08
II	Energy Environment	08	4	-	4	08
III	Energy Management and Audits	12	4	6	4	14
IV	Energy Efficiency & Energy Conservation in Electrical Utility	14	4	6	6	16
V	Energy Efficient Technology in Electrical System	10	2	4	4	10
VI	Energy Conservation through Cogeneration and Tariff	12	2	6	6	14
TOTAL		**64**	**18**	**24**	**28**	**70**

R- Remembering, U - Understanding, A- Applying (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

Sr.No.	NAME	
1	Internal	Mr.N D Adate
2	Internal	Ms. U H Sawant
3	External	Dr. P N Padghan
		Organization : Government Polytechnic, Mumbai

Shri Vile Parle Kelavani Mandal's

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

TEACHING AND EXAMINATION SCHEME

FULL TIME

PROGRAMME: ELECTRICAL ENGINEERING **With effect from Batch admitted in June, 2022(Progressively)**

SEMESTER-V

INPLANT TRAINING (IPT220318)

Sr.NO	Course Name & Code	Training Duration	Credits	Marking System	Weekly Report	Quiz Test	Dissertation	ORLA/Viva	Total
1	# Inplant Training (IPT220318)	26 Week**	20	Maximum Marks	50	50	50	50	200*
				Minimum Marks	20	20	20	20	80

*** To be converted to out of 100 Marks for award of Diploma**

****TOTAL INPLANT TRAINING DURATION 26 WEEKS EQUALS TO 24 WEEKS ACTUAL TRAINING PLUS 2 WEEKS EXAMINATION AND PROCESSING**

 # Award winning , Weekly Reports and Quiz Test are assessed by Internal Examiner Only, Dissertation and Oral/Viva are Assessed by Internal and External Examiners Joinlty.

Gr-Group,, B-Basic, C-Core, A-Applications, M-Management

Head of Department **Controller of Examination** **Secretary CDC** **Principal**

1. COURSE DETAILS

Programme: Electrical Engineering	**Semester: V**
Course: # Inplant Training	**Group: A**
Course Code: IPT220318	**Duration: 26 Weeks**

2. EXAMINATION SCHEME

Sr No	Course Name	Training Duration	Credits		Weekly Report	Quiz Test	Dissertation (Report)	Oral/ Viva	Total	Group (Gr)
1	#Inplant Training IPT**220318**	26 Weeks **	20	**Maximum Marks**	50	50	50	50	200*	A
				Minimum Marks	20	20	20	20	80	

***To be converted to out of 100 marks for award of Diploma**

3. COURSE OBJECTIVE: -

This course will make the student conversant with industrial activities, organizational behavior and ethics. They will understand various industrial aspects viz. manufacturing processes, industrial design, productivity improvement, value engineering, quality control.

They will also analyze and solve engineering problems from industry.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

- **Soft Skills:** Communication, Presentation and Liaising.
- **Life skills: Time** management, Safety, Innovation, Entrepreneurship, Team building.
- **Hands-on:** Reading Drawings, Design, Implementation, Quality Assurance aspects, Servicing and Maintenance
- **Industry specific software and hardware tools.**

5. COURSE OUTCOMES(COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Communicate effectively.
CO2	Prepare and present the report of the work carried out.
CO3	Exercise time management and safety aspects in the work environment.
CO4	Work in a team.
CO5	Demonstrate various quality assurance.
CO6	Design applications and troubleshoot technical problems.

6. CO-PO CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Inplant Training IPT220318	CO1	2	3	-	2	1	3	2	2	2
	CO2	2	3	2	-	1	3	-	2	2
	CO3	3	-	2	3	3	-	2	3	2
	CO4	3	1	-	1	2	3	-	2	2
	CO5	3	1	2	3	3	-	2	2	3
	CO6	2	3	3	1	-	1	2	3	3
	CO Avg.	**2.50**	**2.20**	**2.25**	**2.00**	**2.00**	**2.50**	**2.00**	**2.33**	**2.33**

7. IMPLEMENTATION STRATEGY (PLANNING)

Training is organized in one or more areas, such as, design and development, production, processing, maintenance service, construction, engineering and development. Relevant informationabout different industries participating in training scheme can be hadfrom the following sources:

1)Respective Heads of Departments and

2)Training and Placement Officer.

Eligible Students can seek guidance from Head of Department, Placement Co-oordinator, Faculty Members and Training & Placement Officer for selection of industry. Students should give choice of industries in order of preference,to the Training and Placement Officer through concerned Head ofDepartment /Placement Co-coordinator (keeping in view facilities available and individual's interests).

A student can also be placed in a new establishment, which has adequate training facilities, if specific request for approval is madeprior to the start of placement activities. Some companies interview and select the candidates. The interviews may be conducted in the Company premises or in our institute. Students will be given chance to appear for an interview if they satisfy the minimum requirements laid down by theestablishment. **Once selected, no student will be allowed toappear for subsequent interviews with**

other establishment. Students will be placed at other available establishment depending upon the availability of seats, choice and merit. Students are required to be in touch with their Department and finalize their placement.

Once placed into a particular establishment**, students are notallowed to change that establishment on any account.** Factors like closeness to residence, rate of stipend paid, etc. will have to be taken into account only at the beginning of training in the large interest of the polytechnic.

SUPERVISION:

We have organized a well-planned system for supervision of our students while they are in training. A member of staff is assigned to a group of students and firms. He/She visits each student once a fortnight on the average (10 visit in six months) and maintains close liaison with his/her counterpart in the organisation. In case of any problem or difficulty, student have to contact their Polytechnic supervisor and communicate. All reports, quiz tests, records and inplant training work are to be submitted through this polytechnic supervisor. Respective Heads of Department of concerned disciplines are in charge of satisfactory operation of the scheme including placement, supervision, evaluation and problem solving. Overall co-ordination of the programme is effected by Principal's Office and Training and Placement Officer.

In case of strike/lockout or urgency, students should contact Training and Placement Officer and concerned Head of Department.

8. EVALUATION CRITERIA

Guidelines set up for evaluation of the Inplant Training work for students

Evaluation of training is done on completion and carries marks out of 200.These marks are subdivided into four subheads as follows

1)	Attendance and progress report (work Diary)	50 marks
2)	Quiz tests	50 marks
3)	Inplant training report	50 marks
4)	Oral based on inplant training report/Training presentation	50 marks
	Total:	200 marks

1) Work Diary (50 Marks):

You are required to maintain the record of day-to-day work done by you. Such records are called "Work Diaries" or "Progress Report". You have to write these reports regularly in the prescribed forms supplied to you. All days for the week should be accounted for clearly giving attendance, leave, holidays, etc. The concerned supervisors are required to check periodically these progress reports and also record proper remarks regarding **attendance, conduct/discipline, progress, motivation and Co-operation** and allot marks out of 10. At the end of the training, the supervisors will convert these 120 marks(12 fortnights x 10 Marks= 120 Marks) out of 50 Marks.

2) Quiz Test (50 Marks)

Quiz tests are planned to check the gains through observation, library work and discussions during Inplant Training. If you are just roaming about and loitering in the plant or on the site, you will not be able to perform well in these tests. Five tests, one at end of every month, are prescribed. Each test should have about 5 questions. The questions will be set and assessed by the Industry/Polytechnic Supervisor when he visits your organisation. **These will be based on factory**

product and processes, general functioning of the factory organisation and / or construction site details. The questions will be short and quiz type involving short description and sketches wherever necessary. Each test will be given marks out of 10 so that marks will be awarded out of 50 for 5 quiz tests in `Evaluation of Training'.

3) Inplant Training Report (50 Marks)

In addition to the work diary, students are required to submit a comprehensive report on training along with details of the organisation/factory, where you have received training.

Semester students need to submit a detailed report of their training in the industry incorporating study of plant/ product/process/construction along with Intensive In-depth study of anyone topics such as (1) Processes (2) study on methods (3) tooling (4) construction (5) equipment (6) programming (7) coding (8) testing, maintenance and servicing highlighting aspects of Quality, Productivity and System. Student should take notes throughout his training period and prepare a framework in consultation with factory and polytechnic supervisor. The final report should be completed in last fortnight/week of the training period. **Any data, drawings, etc. should be incorporated with the consent of the firm.** This report will carry 50 marks.

The Trainee may seek guidance for the training from the officials of the organization or Institution supervisors/ library. The matter could be further supplemented by data based on personal observation, references from the Company Catalogue, Manuals, Literature etc. Direct transfer of material from books, periodicals, Literature etc. is not acceptable.

Presentation of the Reports:

The report should be submitted in the form of volumes in duplicate. The matter should be typed on bond papers, with double spacing andtyping should be done on one side. The coverage shall besupplemented by diagrams/ sketches/graphs etc.

Trainees should not present any company information/ drawing, sketches etc. without the prior permission of the factory officials. They should therefore, attach a `No Objection Certificate' from thecompany in their report while presenting it for evaluation.

Inplant Training Report Formatting Guidelines:

Paper:

The report shall be printed on white bond paper, whiteness 95% or above, weight 70 gram or more per square meter. The size of the paper shall be standard A4; height 297 mm, width 210 mm.

Type Setting, Text Processing and Printing:

The text shall be printed on single side of a page employing laser jet or Inkjet printer, the text having been processed using a standard text processor. The standard font shall be "Times New Roman of 12 pts with 1.5 line spacing".

Page Format: The Printed Sheets shall have the following written area and margins:

Top Margin	15 mm
Left Margin	30 mm
Right Margin	20 mm
Bottom Margin	22 mm
Head Height	3 mm
Head Separation	12 mm
Footer	3 mm
Foot Separation	10 mm
Text Height	245 mm
Text Width	160 mm

When header is not used the top margin shall be 30 mm.

Pagination:
Page numbering in the text of the report shall be Hindu numerals at the center of the footer. Page number "1" for the first page of the chapter shall not appear in print; only the second page will bear the number "2". The subsequent chapters shall begin on a fresh page. Pagination for pages before the Introduction chapter shall be in lower case Roman numerals, e.g., "iv".

Header:
When the header style is chosen, the header can have the Chapter number and Section number (e.g., Chapter 2, Section 3) on even numbered page headers and Chapter title or Section title on the odd numbered page header.

Paragraph format:
Vertical space between paragraphs shall be about 2.5 line spacing. The first line of each paragraph should normally be indented by five characters or 12mm. A candidate may, however, choose not to indent if she/he has provided sufficient paragraph separation. A paragraph should normally comprise more than one line. A single line of a paragraph shall not be left at the top or bottom of a page. The word at the right end of the first line of a page or paragraph should, as far as possible, not be hyphenated.

Chapter and Section Format:

Chapter:

Each chapter shall begin on a fresh page with an additional top margin of about 75mm. Chapter number and title shall be printed at the center of the line in 6mm font size 18pt in bold face using both upper and lower case all capitals or small capitals shall not be used. A vertical gap of about 12 mm spacing after font size 36 with single line spacing shall be left between the Chapter number and Chapter title lines and between chapter title line and the first paragraph.

Sections and Subsections:
A chapter can be divided into Sections, Subsections and Sub-sub Sections so as to present different concepts separately. Sections and subsections can be numbered using decimal points, e.g. 2.2 for the second section in Chapter 2 and 2.3.4 for the fourth Subsection in third Section of Chapter 2. Chapters, Sections and Subsections shall be included in contents with page numbers flushed to the right. Further subsections need not be numbered or included in the contents. The Section and section titles along with their numbers in 5 and 4mm (16 and 14 pt) fonts, respectively, in bold face shall be flushed to the left (not centered) with 15 mm space above and below these lines. In further subdivisions character size of 3 and 3.5 with bold face, small caps, all caps and italics may be used for the titles flushed left or centered. These shall not feature in the contents.

Table / Figure Format:
Tables and figures should be presented in portrait style as far as possible. Small size table and figures (less than half of writing area of a page) should be incorporated within the text, while larger ones may be presented on separate pages. Table and figures shall be numbered chapter wise. For example, the fourth figure in chapter 5 will bear the number Figure 5.4 or Fig 5.4. Table number and title will be placed above the table while the figure number and caption will be located below the figure. Reference for Table and Figures reproduced from elsewhere shall be cited in the last and separate line in the table and figure caption.

Index of Inplant Report:

INSTITUTE – VISION and MISSION statement

PROGRAM - VISION and MISSION statement

PROGRAM – PEOs and PSOs

(1) Introduction. (Report/Project work)

(2) Company background-organisation and activities

(3) Training/Training Area

(4) Scope and object of the Study with diagrams, sketches and relevant and authentic data based on literature survey/personal/observation, etc.

(5) Result/Inference/Conclusion.
(6) Acknowledgements.
(7) List of References (Library Books, Magazines and other sources)

Guidelines for evaluation of the inplant report:

The inplant report so submitted will be evaluated as under:

1) Intro duction, acknowledgements, references.	
2) Company background activities	
3)Training area/Training details	10 Marks
4)General presentation, neatness and accuracy of the data furnished	10 Marks
5) Study contents with data graphs, drawing and observation	20 marks
6) Result, inference/conclusion	10 marks
	Total: 50 Marks

4) Oral based on inplant report/ presentation (50 Marks)

Guidelines for Evaluation at Oral/viva Examination:

Fifty marks are reserved for the systematic presentation of the inplant training report giving scope and objective of the training and approach with following details:

1) Student presentation -20 Marks
2) Questions and answers - 20 Marks
3) Practical skills acquired -10 Marks

9. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Shri N D Adate
2	Internal	Mrs. A N Kinhekar
4	External	Mr. Ricky Uchil
		Organization: Ex-Vice President Adani Electricity, Mumbai

Title Sheet (Specimen A)

Inplant Training Report

On

Submitted in partial fulfillment of the requirement for the award of the

DIPLOMA in ----------

By

Under the guidance of

Mr./Mrs. ----------

Shri Vile Parle Kelavani Mandal's

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

Academic Year: 20 - 20

Certificate (Specimen B)

Shri Vile Parle Kelavani Mandal's

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

CERTIFICATE

This is to certify that the Inplant Training Report is a bonafide work of

Roll No **Student Name**

Submitted in partial fulfillment of the requirement for the award of Diploma in ----------
---------Engineering.

Supervisor/ Guide **Head** **Principal**

Shri Vile Parle Kelavani Mandal's

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

Approval Sheet

This is to certify that the Inplant Training Report on ---------- is prepared by

Roll No **Student Name**

In partial fulfillment for the award of Diploma in ----------Engineering

Signature:----------

Name:----------

Internal Examiner

Signature:----------

Name:----------

External Examiner

Date:

Place: